STANDARDS ALIGNMENT

Arizona Academic Standards

Aligned to Thinking About Values in Astrobiology"

High School | Arizona Department of Education 2018 Standards

> *Source: Arizona Department of Education (azed.gov), 2018 Arizona Science Standards and 2018 Arizona History and Social Science Standards (modified August 2019). Standard codes verified through the Mesa Public Schools Curriculum Guide and the ADE standards database. Teachers are encouraged to confirm codes against the full ADE standards documents available at azed.gov/standards-practices before use in official planning documents.*

Arizona Science Standards (AzSS) — High School

The Arizona Science Standards (adopted October 2018) are built around three integrated dimensions: Science and Engineering Practices, Crosscutting Concepts, and Core Ideas. Each standard code reflects the intersection of a Core Idea for Knowing Science and a Core Idea for Using Science. The most directly applicable "Using Science" core idea for this lesson is U3: Applications of science often have both positive and negative ethical, social, economic, and/or political implications.

Life Science Standards

HS.L1U3.23	Obtain, evaluate, and communicate the ethical, social, economic, and/or political implications of the detection and treatment of abnormal cell function. (The U3 "Using Science" framework connects science content to societal implications and applies broadly across this lesson's ethical scenarios.)
HS.L2U3.18	Obtain, evaluate, and communicate about the positive and negative ethical, social, economic, and political implications of human activity on the biodiversity of an ecosystem. (Directly relevant to Scenario 1: The Microbe on Enceladus and questions of ecosystem protection.)
HS.L4U3	Using Science Core Idea U3: Applications of science often have both positive and negative ethical, social, economic, and/or political implications. (This core idea threads through all HS standards coded U3 and is the primary science standards connection for this lesson.)

Earth and Space Science Standards

HS.E2U1.17	Construct an explanation of the origin, expansion, and scale of the universe based on astronomical evidence. (Provides science content background relevant to the lesson's framing of humanity's place in the cosmos.)
HS.E2U1.16	Construct an explanation of how gravitational forces impact the evolution of planetary motion, structure, surfaces, atmospheres, moons, and rings. (Background knowledge relevant to planetary habitability and the settings of the discussion scenarios.)

Science and Engineering Practices (embedded across all AzSS standards)

Asking Questions	Students generate and refine questions about scientific phenomena and their societal implications, a core activity in the article reading and scenario discussions.
Engaging in Argument from Evidence	Students construct, defend, and critique arguments using scientific and ethical evidence across all three discussion scenarios.
Obtaining, Evaluating, and Communicating Information	Students read and evaluate the student article, then communicate their reasoning in small-group and whole-class discussions.
Constructing Explanations	Students develop explanations for complex phenomena at the intersection of science and ethics, including planetary protection and the definition of life.

Arizona History and Social Science Standards — High School

The Arizona History and Social Science Standards (adopted October 2018, modified August 2019) are organized around 21 Anchor Standards in civics, economics, geography, and history, plus four Disciplinary Skills and Processes standards that apply across all content areas. The Disciplinary Skills and Processes standards are especially well-aligned to this lesson's discussion-based format.

Disciplinary Skills and Processes

HS.SP2.1	Analyze the relationship between multiple perspectives and a given historical event, contemporary issue, or government policy. (Students examine how different stakeholders — scientists, Indigenous communities, governments, the public — bring different perspectives to decisions about extraterrestrial life.)
HS.SP3.1	Gather, evaluate, and interpret multiple sources of information to support claims, develop a position, and communicate conclusions. (Students use the article and scenario evidence to build and defend positions in small-group discussion.)
HS.SP4.1	Analyze multiple and complex causes and effects of events in the past and present. (Students trace chains of cause and effect in the scenarios, including the consequences of acting — or not acting — under uncertainty.)

Civics

HS.C4.4	Analyze the purpose, process, implementation, and consequences of decision-making and public policies in multiple settings and at various levels. (All three scenarios require students to evaluate who makes decisions, what processes are used, and what the consequences might be.)
HS.C4.5	Use disciplinary and interdisciplinary lenses to understand the characteristics and causes of local, regional, and global problems, instances of such problems, and approaches to addressing them. (This lesson explicitly uses science, philosophy, and social science lenses to analyze problems at a planetary and cosmic scale.)

Geography

HS.G4.1	Evaluate how changes in the environment and technology affect human society and the physical environment. (Students consider how advances in space exploration technology create new ethical and governance challenges for humanity.)

Arizona English Language Arts Standards — Grades 9–12

The Arizona ELA Standards (adopted 2016, updated) define what students need to know and be able to do in reading, writing, speaking, and listening. This lesson directly engages Reading Informational Text, Speaking and Listening, and Writing standards across grades 9–12. Standards are listed at the 9–10 and 11–12 bands; teachers should select the band appropriate to their students.

Reading Informational Text

RI.9-10.6 / RI.11-12.6	Determine an author's point of view or purpose in a text and analyze how an author uses rhetoric to advance that point of view or purpose. (Students evaluate how the article frames astrobiological values as arguments rather than established facts.)
RI.9-10.8 / RI.11-12.8	Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is sufficient. (Students assess the article's claims about intrinsic value, planetary protection, and non-anthropocentrism.)
RI.9-10.9 / RI.11-12.9	Analyze seminal texts and documents of historical and scientific significance, including the ideas present and the rhetorical features that make them effective. (Optional extension: students compare the article's framing of scientific values to historical scientific documents or policy texts such as the Outer Space Treaty.)

Speaking and Listening

SL.9-10.1 / SL.11-12.1	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners; come prepared, explicitly draw on evidence, and respond

	thoughtfully to diverse perspectives. (The core activity of the small-group scenario discussions and whole-class debrief.)
SL.9-10.4 / SL.11-12.4	Present information, findings, and supporting evidence such that listeners can follow the line of reasoning; address alternative or opposing perspectives. (Students present their group's position and respond to challenge questions from peers.)
SL.9-10.5 / SL.11-12.5	Make strategic use of digital media in presentations to enhance understanding of findings, reasoning, and evidence. (Optional extension: students create multimedia presentations of their council statements or arguments.)

Writing

W.9-10.1 / W.11-12.1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence, acknowledging and addressing counterclaims. (Reflective journal entries and the council statement extension ask students to write structured arguments with counterclaims.)
W.9-10.9 / W.11-12.9	Draw evidence from literary or informational texts to support analysis, reflection, and research. (Students use the article and scenario details as textual evidence in their written responses.)

A Note on Interdisciplinary Alignment

This lesson is unusual in the breadth of its standards alignment, touching science, social studies, and ELA in a single instructional sequence. That breadth reflects the nature of astrobiology itself, which is inherently interdisciplinary and asks students to move between empirical evidence and ethical reasoning, between scientific content and humanistic values.

Teachers in a single-subject setting should feel confident claiming alignment with their own content area standards. Teachers working in interdisciplinary teams may find this document useful for co-planning and for demonstrating to administrators that the lesson covers meaningful ground across multiple required domains.

The ADE standards documents in their complete form are available at:

Science: azed.gov/standards-practices/k-12standards/standards-science

History and Social Science: azed.gov/standards-practices/k-12standards/standards-social-studies

English Language Arts: azed.gov/standards-practices (select ELA Resources)